VTT Technical Research Centre of Finland

Development of Textile recycling chain in Finland

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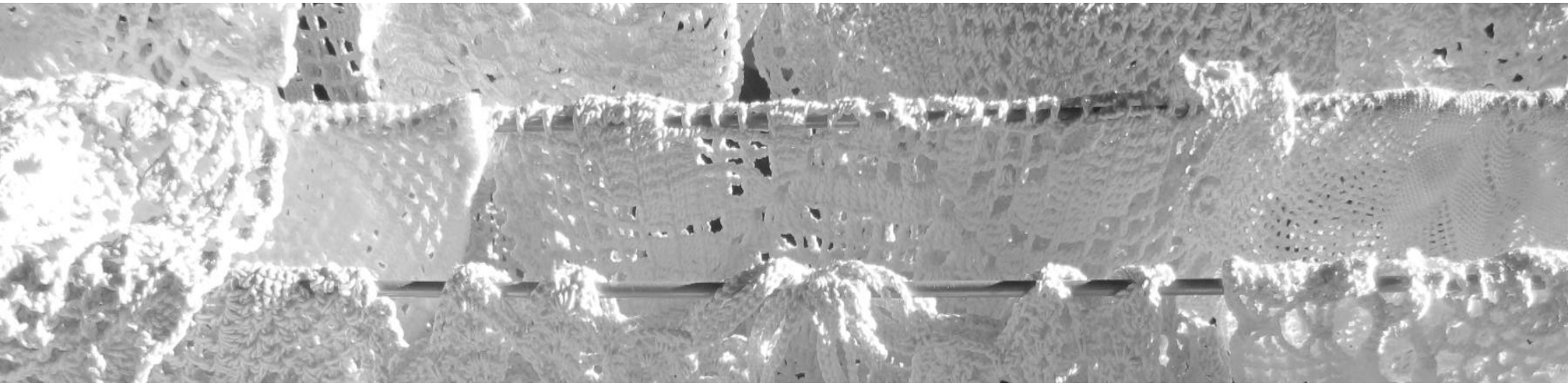
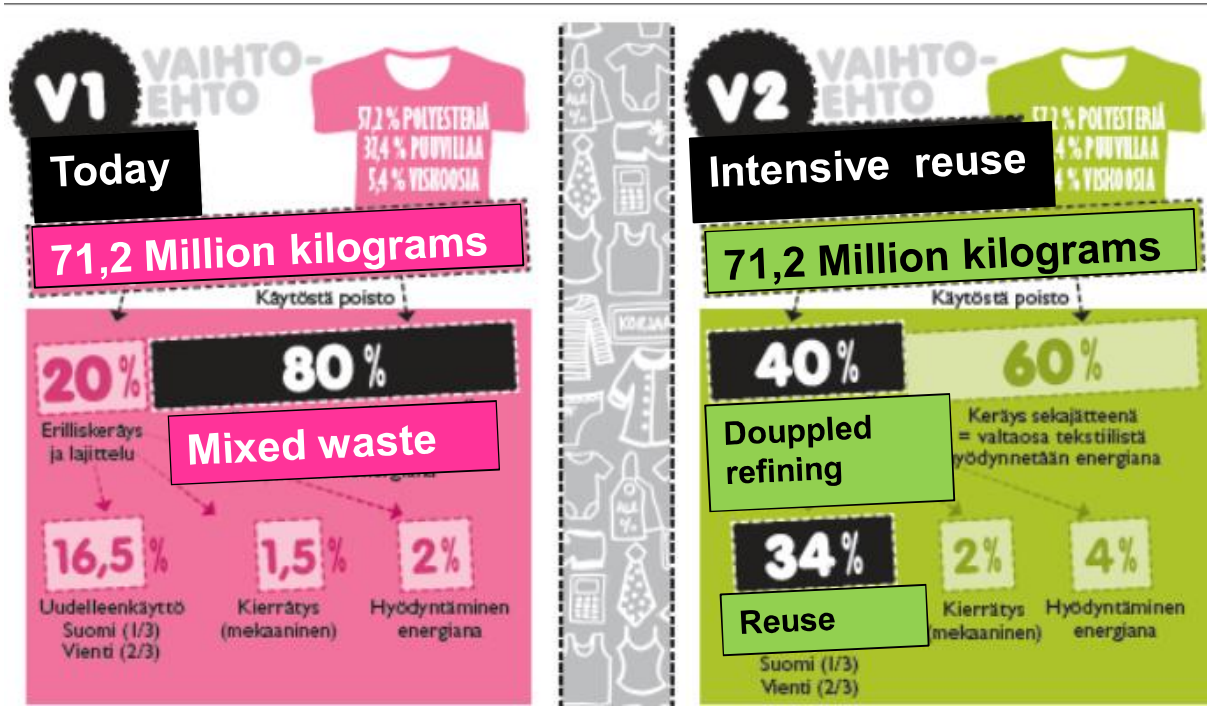


Development of Textile recycling chain in Finland – insights of TELAKETJU project

6th International Textile Recycling Conference, Manchester 07.06.2017
Prof. Ali Harlin, Pirjo Heikkilä, VTT Technical research centre of Finland Ltd,
Henna Knuutila, Sini Ilmonen / Turku University of Applied Sciences

Finland now and in future



Referenece: Environment Intitute of Finland, Texjäte project

WEAR. RECYCLE. REPEAT

The Relooping Fashion Initiative

The Relooping Fashion Initative received a Highly Commended status in the Awards Program's public sector category in The Circulars 2016 Awards Ceremony held at the WEF Meeting in Davos on 19 January. The Circulars is the world's premier circular economy award programme, whose judging panel includes the circular economy pioneers such as Ellen MacArthur and William McDonough, as well as representatives from global business and university sector.

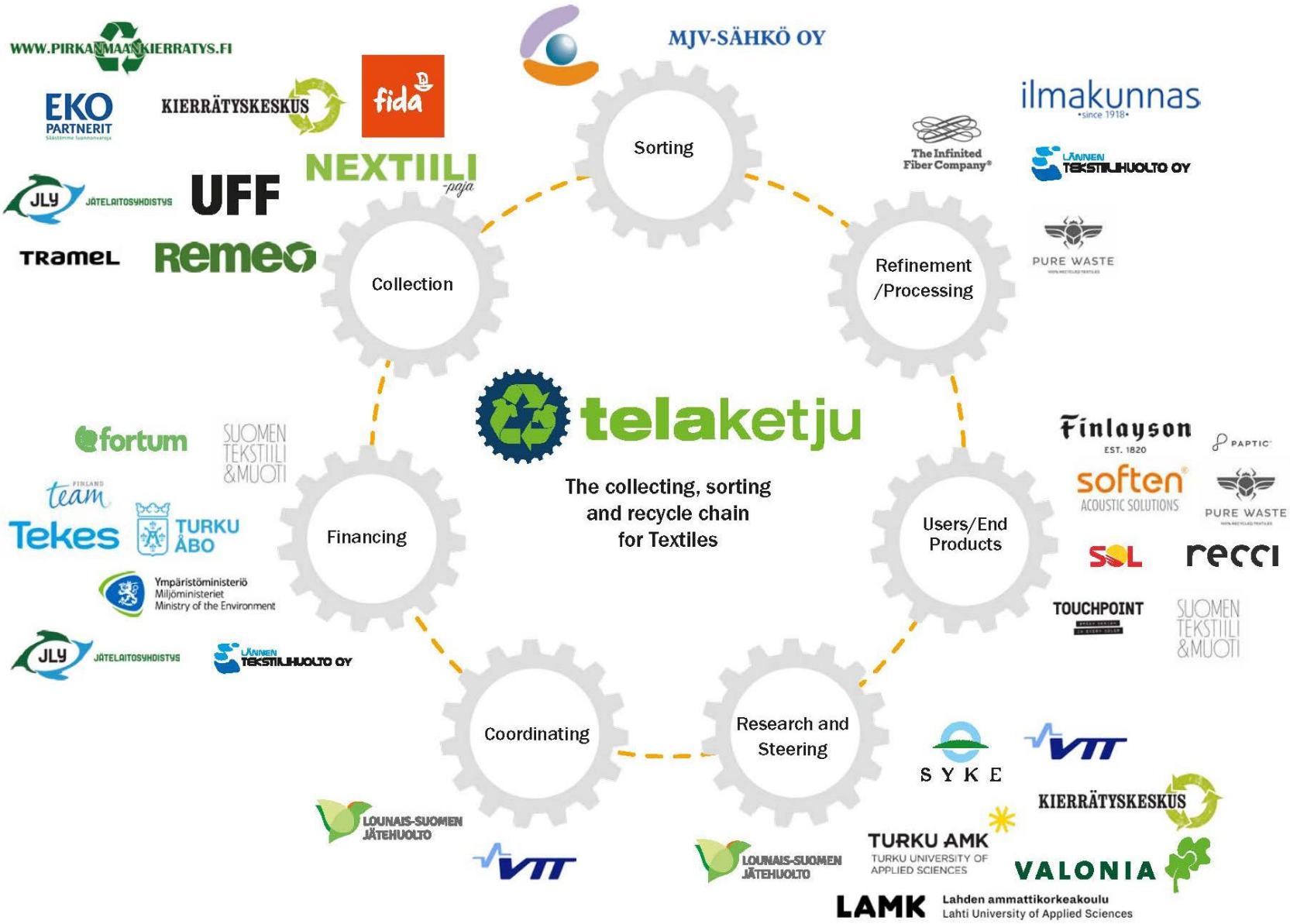
Re-producing old cotton clothing into new material has been very challenging, because the worn-out fibers are too short to be spun into new thread. New cotton also needs to be added to each batch, **making 100% post-consumer-waste textiles an impossible dream**.

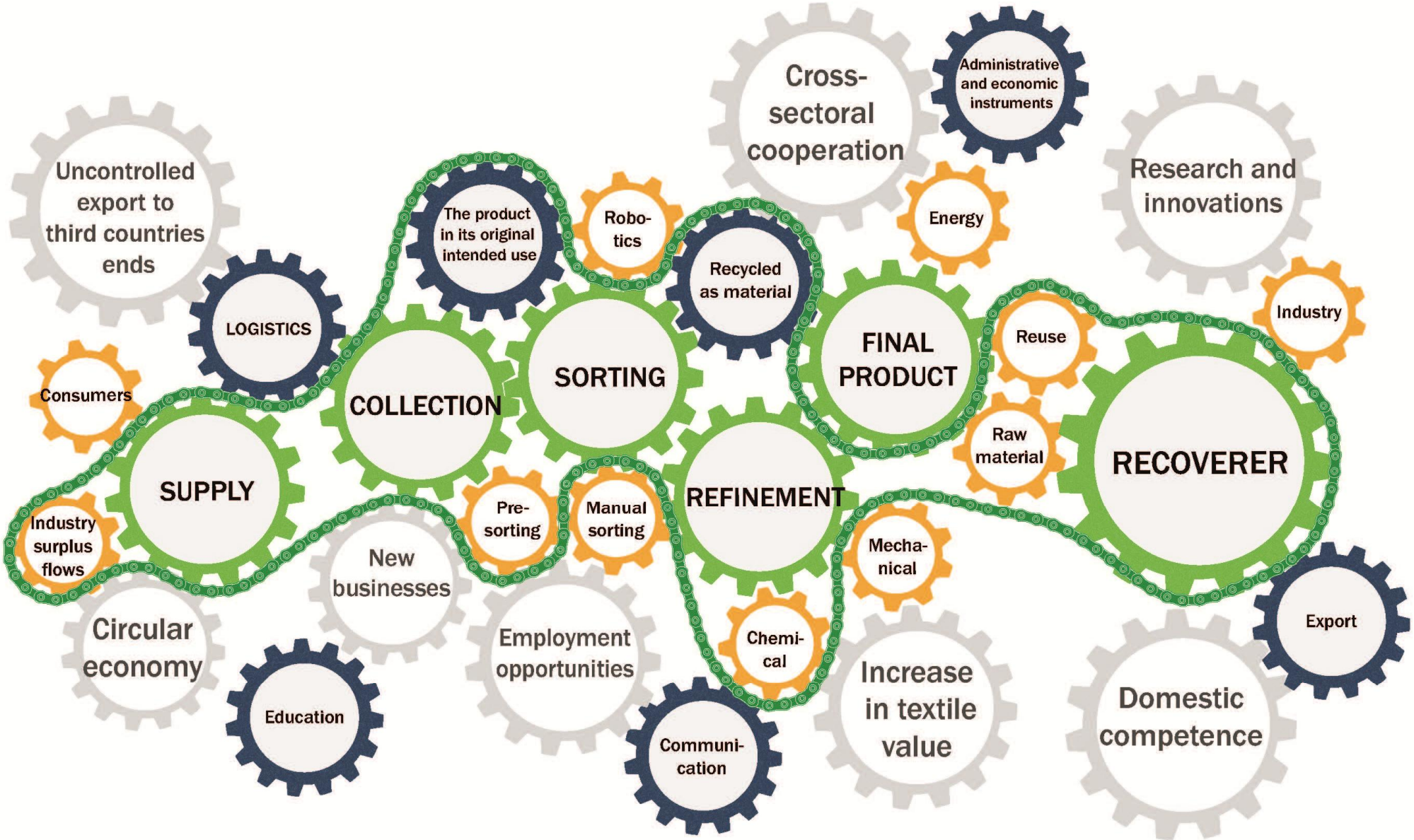
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 646226

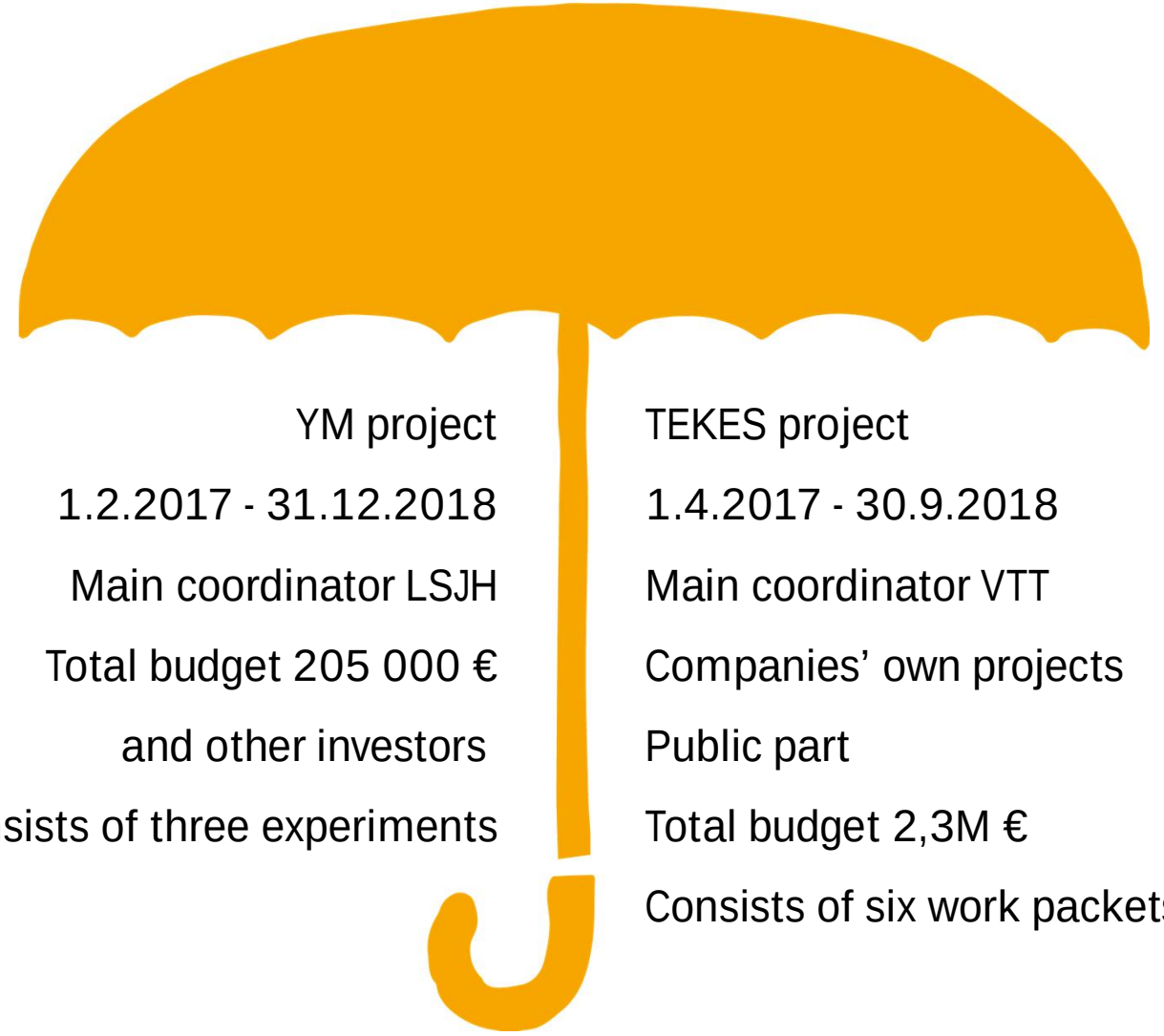
Cellulose Carbamate technology in EU Trash to Cash

- EU funded project Trash to Cash aims to utilise the zero-value waste textiles and fibres with design-driven technologies to create high quality products.
- Coordinator of the project is SP Technical Research Institute of Sweden

- VTT's efforts include:
  - chemical pretreatment of cotton and CO/PES waste materials to remove impurities and to decrease DP (cellulose)
  - carbamation of the pretreated materials
  - dissolution of CCA and preparation of regenerated fibres
  - dissolution of carbamated CO/PES blends and separation of the PES fraction for purification, characterisation and reuse


telaketju
The collecting, sorting and recycle chain for Textiles
Sorting
Refinement /Processing
Users/End Products
Research and Steering
Coordinating
Financing
Collection
MJV-SÄHKÖ OY
ilmakunnas
since 1918
The Infinited Fiber Company
LÄNNEN TEKSTIILIHUOLTO OY
PURE WASTE
Finlayson
EST. 1820
PAPTIC
soften
ACOUSTIC SOLUTIONS
PURE WASTE
SOL
recci
TOUCHPOINT
SUOMEN TEKSTIILI &MUOTI
SYKE
VTT
KIERRÄTYSKESKUS
TURKU AMK
TURKU UNIVERSITY OF APPLIED SCIENCES
VALONIA
LAMK
Lahden ammattikorkeakoulu
Lahti University of Applied Sciences
LOUNAIS-SUOMEN JÄTEHUOLTO
VTT
fortum
SUOMEN TEKSTIILI &MUOTI
Team Finland
Tekes
TURKU ÅBO
Ympäristöministeriö
Miljöministeriet
Ministry of the Environment
JLY JÄTELAITOSYHDISTYS
LÄNNEN TEKSTIILIHUOLTO OY
WWW.PIRKANMAANKIERRATYS.FI
EKO PARTNERIT
KIERRÄTYSKESKUS
fida
NEXTIILI paja
JLY JÄTELAITOSYHDISTYS
UFF
TRAMEL
Remeo


Uncontrolled export to third countries ends
LOGISTICS
Consumers
SUPPLY
Industry surplus flows
Circular economy
Education
New businesses
The product in its original intended use
COLLECTION
Robo-tics
SORTING
Pre-sorting
Manual sorting
Recycled as material
REFINEMENT
Chemi-cal
Communi-cation
Employment opportunities
Cross-sectoral cooperation
Administrative and economic instruments
Energy
FINAL PRODUCT
Reuse
Raw material
Mecha-nical
Increase in textile value
Research and innovations
Industry
RECOVERER
Export
Domestic competence



YM project

1.2.2017 - 31.12.2018

Main coordinator LSJH

Total budget 205 000 €

and other investors

Consists of three experiments

TEKES project

1.4.2017 - 30.9.2018

Main coordinator VTT

Companies' own projects

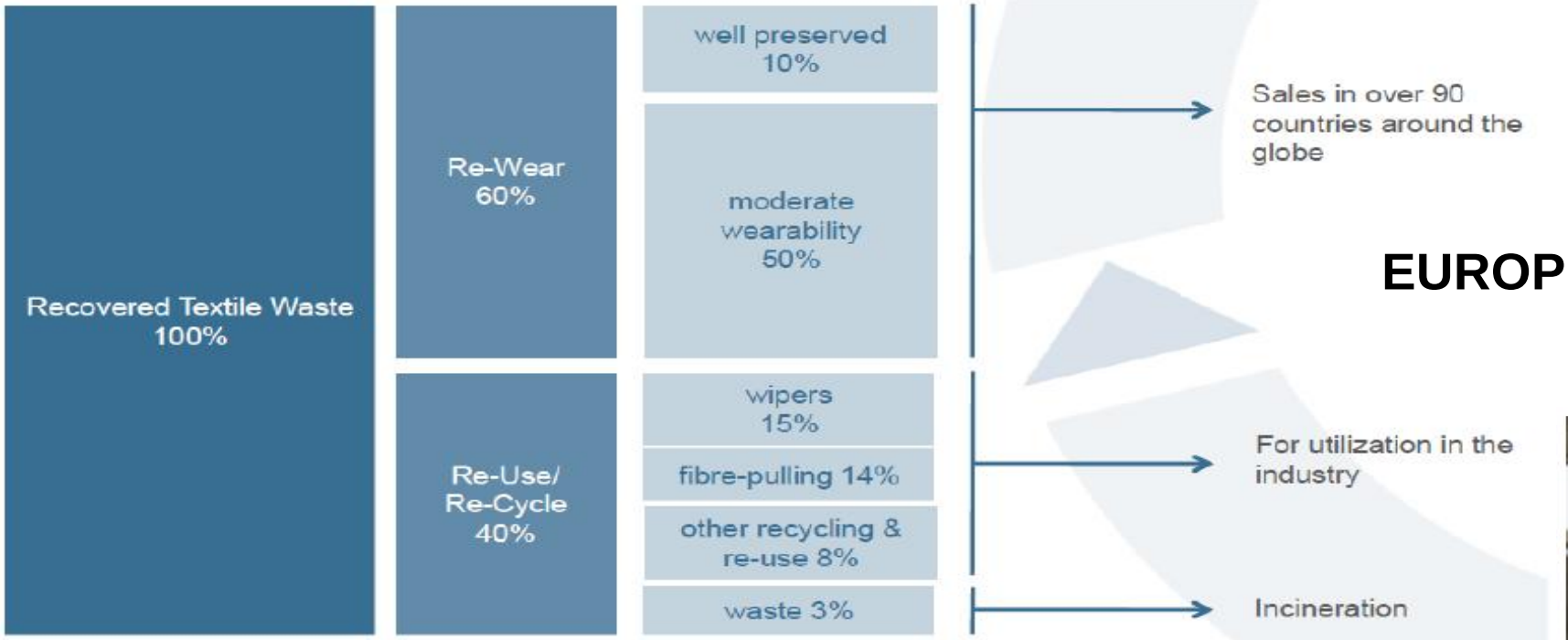
Public part

Total budget 2,3M €

Consists of six work packets

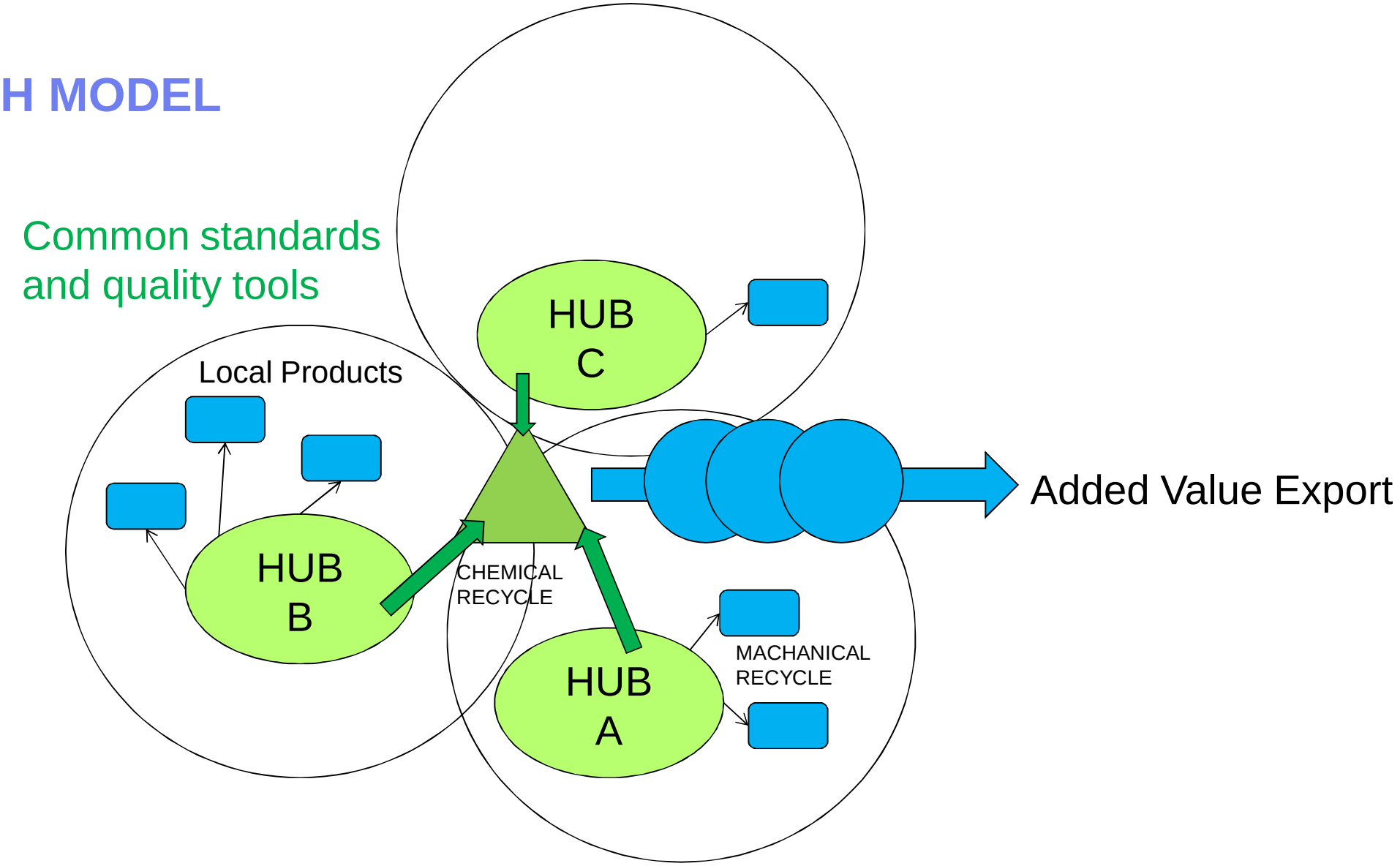
Additionally, includes companies and organisations participating with work, networks, material use and communication. Also international cooperation.

Kuva Inka Mäkiö, Poistotekstiiliketjun roolikartta ja johdonmukainen viestintä



EUROPEAN MODEL

FINNISH MODEL



A project for regional recycling experiments of municipal

TELAKETJU

A collection, sorting and utilisation network for end-of-life textile

EXPERIMENT 1

Creating a national end-of-life textile recycling network and supporting its function

Lounais-Suomen Jätehuolto Oy with TUAS, Finnish Environment Institute SYKE and Valonia

EXPERIMENT 2

Regional textile sorting at the place of origin, textile reception and consumer communication

Lounais-Suomen Jätehuolto Oy with UFF, Ekopartnerit and TUAS

EXPERIMENT 3

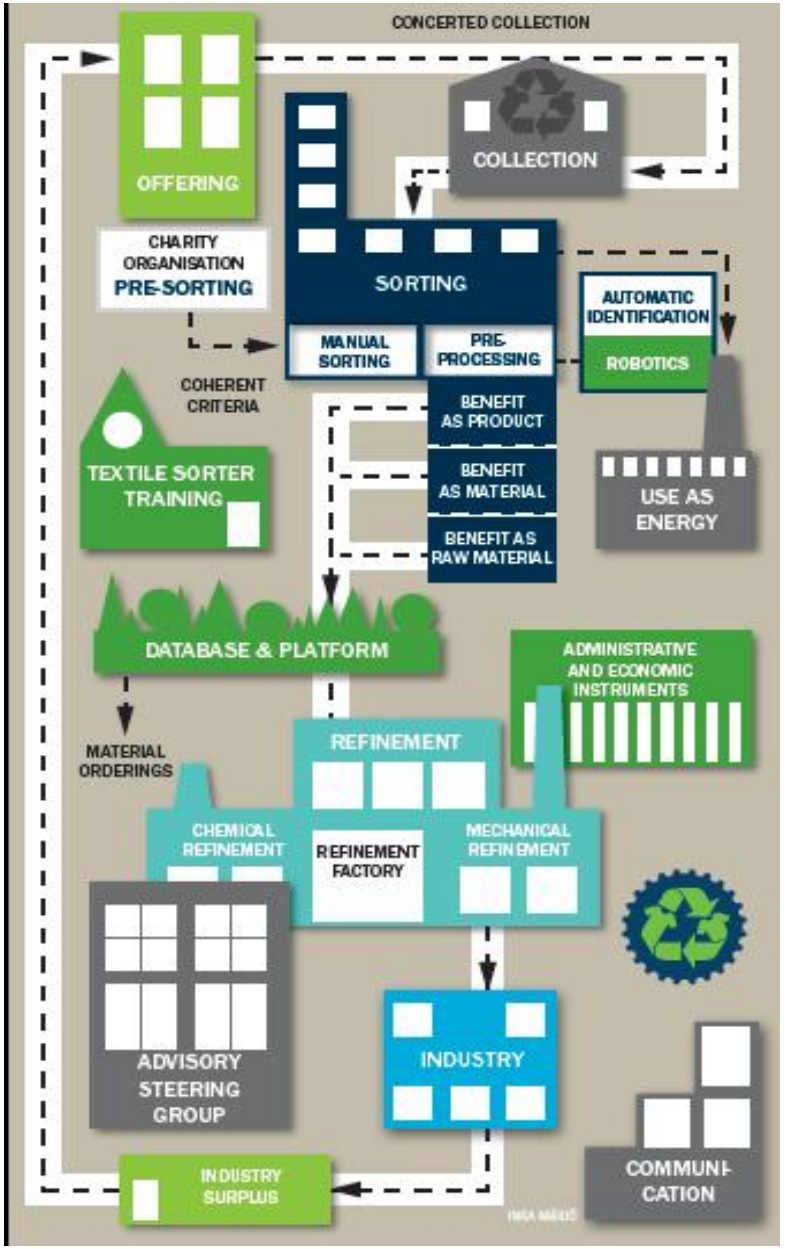
Expertise for textile sorting – Textile sorter training *Telakoulu

Pääkaupunkiseudun kierrätyskeskus with Pirkanmaan kierrätys ja työtoiminta ry, Turun seudun TST ry, TUAS and Fida International

Advisory steering group with the Tekes project.
Executive board consisting of organisations and investors in the project

Other investors in the project:
Ministy of Environment, Jätelaitosyhdistys, Suomen Tekstiili & Muoti ry, Lännen tekstiilihuolto, city of Turku and Fortum Waste Solutions.

telaketju



Bioruukki Pilot Centre

Speed to scale-up of bio and circular economy innovations

- BIOMASS
- WASTE
- SIDE STREAMS

→ **BIORUUKKI** →

INNOVATIVE PROCESSES, VALUE ADDED PRODUCTS & SERVICES

THERMOCHEMICAL CONVERSION PLATFORM
Started Q3/2015

ENERGY STORAGE PLATFORM
Starts 2016

BIOMASS PROCESSING PLATFORM
Starts 2017

GREEN CHEMISTRY PLATFORM
Starts at Bioruukki 2018

- **A new piloting ecosystem** for process industry scale-up and demonstrations.
- A former printing plant transformed to world scale R&D centre.
- 8000 m^2, room for several pilot units and laboratories.
- Located close to Otaniemi campus.

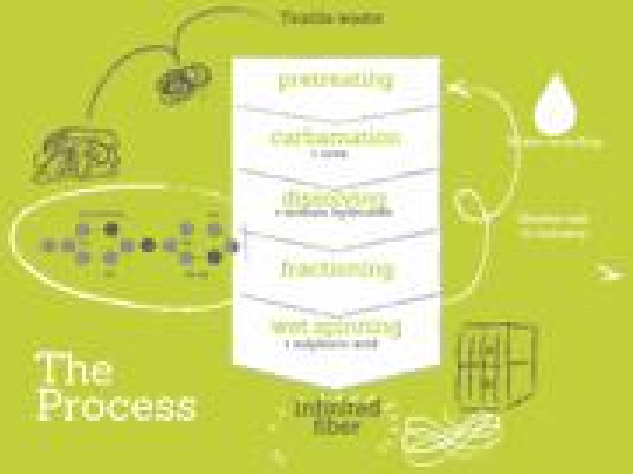
Pilot scale wet spinning machine will be transferred from Valkeakoski to Bioruukki during spring 2017. Capacity of the line is 60 kg fibres /day.

Our breakthrough technology benefits all major stakeholders in the fashion industry value chain

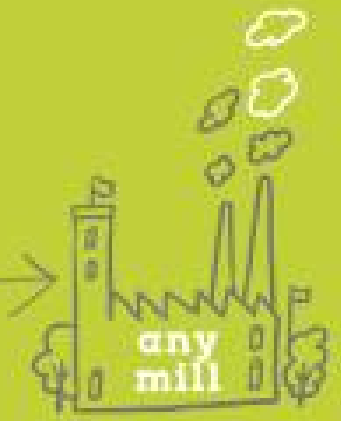
Infinited® fibers are manufactured of textile waste, recycled paper or biomaterials like wood. Technology is patented, proven and competitive.

Fast and low CAPEX market entry by licensing the technology to any pulp and fiber producers or machinery manufacturing companies.

Global market is >$6 billion with >CAGR 10%. Major brands like H&M, IKEA, Levis & Strauss Co have strong interest on our pilot.



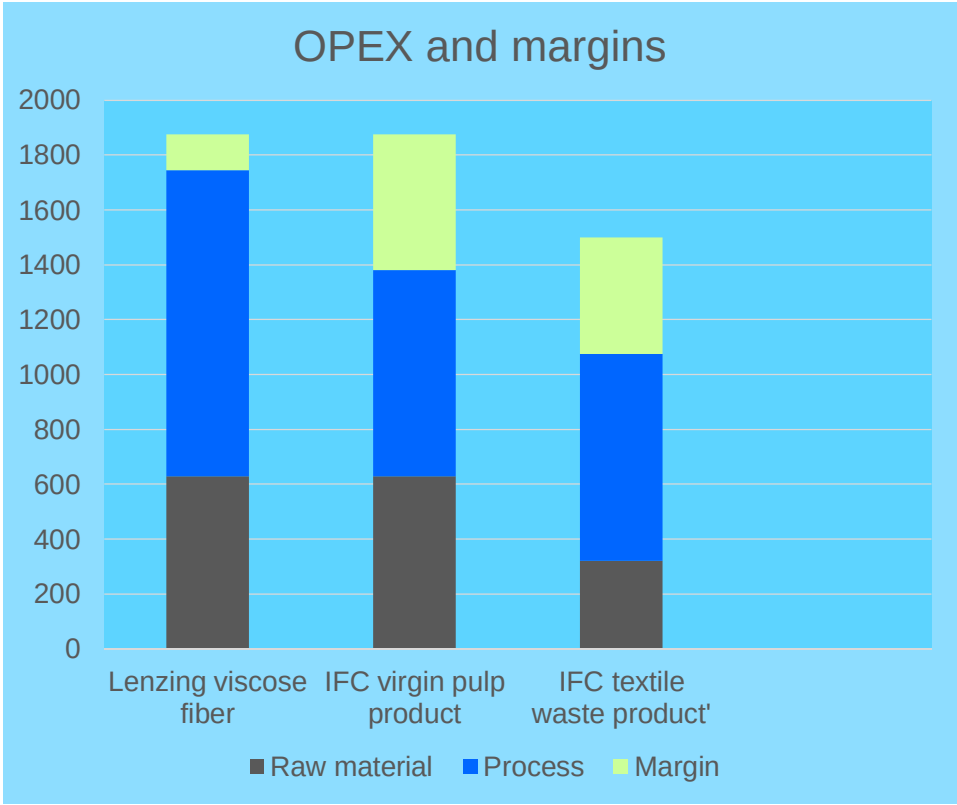
OUR *Core Process* FITS



Sustainable CCA technology

CLIMATE SOLVER 2016 HONOREE
Creating new ways to produce cellulose fibers
Developed by: THE INFINITED FIBER COMPANY

- VTT has developed technology for 20+ years
- Finland is the leading country globally on cellulose chemistry
- Largest scale pilot and very close to industrial process productivity
- Five major competitive edges:
  - *Up to 40% more economical*
  - *Sustainability (infinite loop, ecological chemistry, water utilization, etc.)*
  - *Fastest scale-up as can utilize simultaneously several raw materials*
  - *Minimized CAPEX as technology can be added to any existing pulp or viscose fiber plant*
  - *New business opportunities for the customers*



The technology enables manufacturing fiber equal to Viscose but without CS2

- Technical properties are equal to Viscose
- Touch and feel is more cottonish and colouring feature is better than Viscose has
- Applying for the new trade name to differentiate from Viscose as the process is different

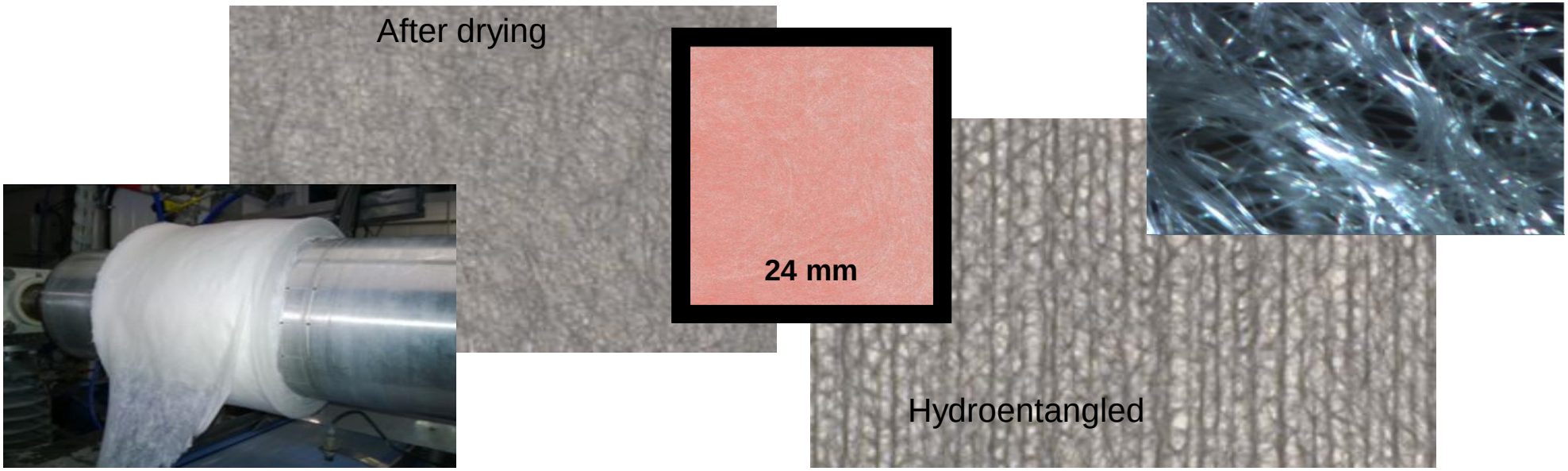
Property	1 Reference: Viscose values (market qty)	2 Infinited fiber made of virgin dissolving pulp	3 Infinited fiber made of recycled paper	4 Infinited fiber made of textile waste
Raw material	Dissolving Pulp (wood)	Dissolving Pulp (wood)	Recycled paper	Textile waste (cotton rich)
Fineness, dtex	1,7	2,0[5]	2,0[5]	2,0[5]
Tenacity (cond.), cN/tex (ASTM 1446D)	26	26	25	22
Elongation (cond.), %	12-14	12	13	16

[1]Tenacity is expressed in relative to the fineness (1 tex = 1 gram per 1000 metres). Figures for tenacity are based on both fiber fineness (tex) and cross-sectional area of the sample conditioned according to technical standard ASTM 1446D (65% relative humidity and temperature of 20°C)
[5]VTT machinery has only this fineness option as per today. According to needs the fineness can be adjusted between 1,3-2,6

Foam-laid nonwovens from cellulosic fibres

Semi pilot scale - Hydroentanglement

- Brilliant formation in the case of long fibres, even though high forming consistency applied
- Mechanical bonding instead of chemical bonding → aspect for sustainability
- Widening of raw material combinations → process simplifying



Mechanical bonding of foam laid nonwovens (MECBO), VTT internal project, 2014

PAPTIC®


PAPTIC® IS A REVOLUTIONARY,
ENVIRONMENTAL NEW MATERIAL
REPLACING PAPER AND PLASTIC

Conclusions

Environmnetaly sustainable and safe recycled textile:

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- Efficent production methods
  - Safe chemistry
  - Less losses
- High performance products
- Properties that can be adjusted
- Startups
  - Demonstration factories
  - Attracting international investments
- Novel businesses
  - Technology
  - Machinery
  - Applied materials

From R&D projects to pilots and startup

The Relooping Fashion Initiative

TRASH CA$H

The Infinited Fiber Company®

WWF CASE 2016

CLIMATE SOLVER 2016 HONOREE

Creating new ways to produce cellulose fibers

Developed by: THE INFINITED FIBER COMPANY

The Circulars 2016 HIGHLY COMMENDED thecirculars.org

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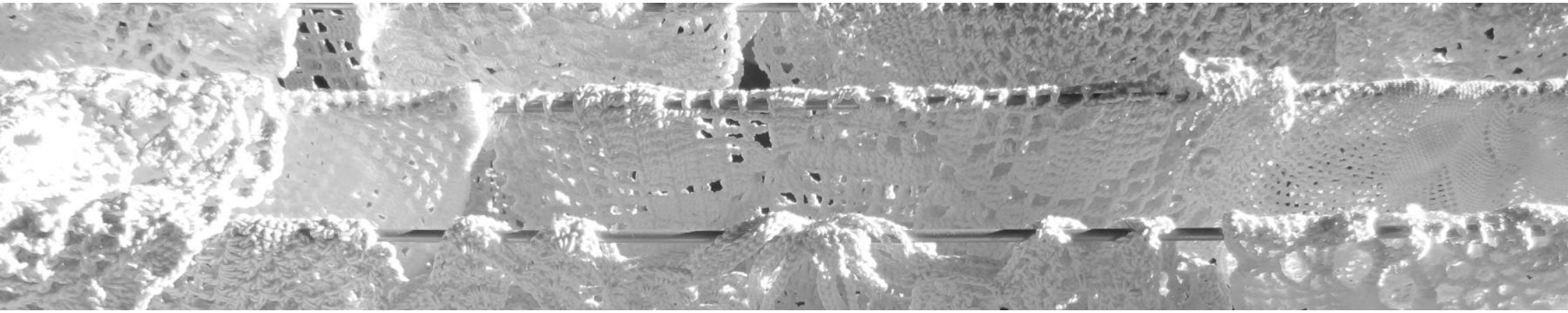

Thank you!

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Instagram: @telaketju_poistotekstiili
#lumpustauutta #poistotekstiili #telaketju

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